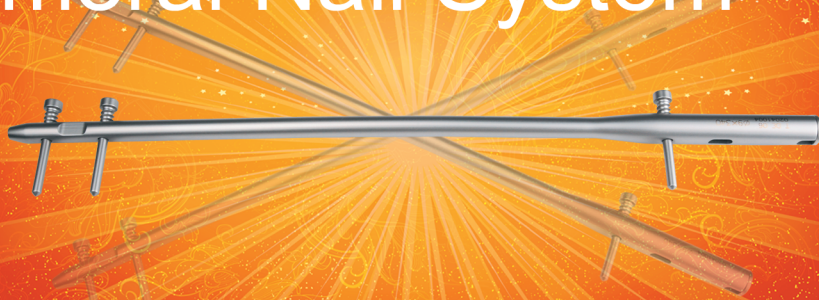


Surgical technique 操作手册



股骨髓内钉内固定系统 Femoral Nail System



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前言

INTRODUCTION

WASTON 股骨交锁髓内钉系统非常适合于治疗股骨干骨折，无论骨折的严重程度，只要小转子保持完整，小转子至髌上部位骨折都适用。开放性骨折通常需要采取别的处理方法，外固定支架可能更适合。

WASTON Femoral Nail System is best suited to fractures in the diaphyseal region, but where necessary, can be used for fractures situated in the region extending from just below the intact lesser trochanter to just above the supracondylar region. The procedure is applicable to any fracture within these boundaries, whatever the degree of comminution. Open fractures often require a different management, and an external fixator may be considered more appropriate in some instances.

适应症

INDICATIONS

股骨交锁髓内钉的适应症包括：

- 创伤骨折
- 病理性骨折
- 股骨再骨折
- 骨不连
- 重建矫形外科

The indications for intramedullary locked nailing include:

- Traumatic fractures
- Pathological fractures
- Re-fractures
- Non-unions
- Reconstructive surgery

植入物

IMPLANTS



股骨髓内钉

Femoral intramedullary nail

工具 INSTRUMENTS



15041-001 瞄准器手柄
Nail Support Handle



15041-002 导杆
Guide Bar



15041-003 远端瞄准支架
Distal Outrigger



15041-104
吊紧螺栓 (M10 × 1)
Locking Rod (M10 × 1)



15041-005 导杆锁轮 (M6)
Guide Bar Locking Screw (M6)



15041-006 支架锁轮 (M8)
Outrigger Locking Screw (M8)



15041-008
T 型定位杆 (Ø5.0)
T-Handled Stabilizing Rod (Ø5.0)



15041-009/109
专用套管 (Ø10 & Ø8.2 / Ø11 & Ø9.2)
Screw Guide (Ø10 & Ø8.2 / Ø11 & Ø9.2)



15041-110/210
软组织分离器 (Ø8/Ø9)
Soft Tissue Protector (Ø8 / Ø9)



15041-011/211/311/411/511
钻套 (Ø2.7/Ø4.2/Ø5.2/Ø7.1)
Drill Guide (Ø2.7 / Ø4.2 / Ø5.2 / Ø7.1)



15041-012
螺纹导针 (Ø2.5 × 250)
Threaded Kirschner Wire (Ø2.5 × 250)



15041-013
测深尺 (50 ~ 110mm)
Depth Gauge (50~110mm)



15041-014
阶梯骨钻 & 限位器 (Ø7.0)
Drill Bit and Slide Limited Device (Ø7.0)



15041-015
上钉 (加压) 扳手 (SW6.0/M4)
T-Wrench with Coupling Screw for
Lag Screw Impactor (SW6.0 / M4)



15041-016
把持器 (M10 × 1)
Handle for Impactor (M10 × 1)

工具 INSTRUMENTS



15041-117
开孔器 (大)
Pointed Awl (large)



15041-218/318/418/518/618/718/818
髓腔绞刀 (Ø8 / Ø9 / Ø10 / Ø11 / Ø12 / Ø13 / Ø14)
Rigid Reamer (Ø8 / Ø9 / Ø10 / Ø11 / Ø12 / Ø13 / Ø14)



15041-019/119
导针 (Ø2.0 × 500mm / Ø2.5 × 600mm)
Guide Wire (Ø2.0 × 500mm / Ø2.5 × 600mm)



15041-420/520
骨钻 (Ø4.0 / Ø5.0)
Drill Bit (Ø4.0 / Ø5.0)



15041-421
骨钻 & 限位器 (Ø4.0)
Drill Bit and Slide Limited Device (Ø3.5 / Ø4.0)



15041-022
T 型平底钻 (Ø5.0)
T-Drill Bit (Ø5.0)



15041-123
套管 (Ø10 & Ø8.2)
Screw Guide (Ø10 & Ø8.2)



15041-025
直角定位杆
Stabilizing Rod



15041-026
测深器 (20 ~ 90mm)
Locking Screw Depth Gauge (20~90mm)



15041-027/127
丝锥 (HA5.0 / HA6.0)
Tap (HA5.0 / HA6.0)



15041-028
T 型六角扳手 (SW3.5)
Screw T-Wrench (Hex, SW3.5)



15041-029/129
L 型六角扳手 (SW2.5 / SW5.0)
Screw L-Wrench (SW2.5 / SW5.0)



15041-230
打拔器手柄 (M10)
Sliding Hammer with Detachable Swing Arm (M10)



15041-031/131 打拔器 (小 / 大)
Adapter for Extractor (small / large)



15041-032
锁钉取出器 (M8 × 1 左旋)
Locking Screw Extractor (M8 × 1, Left)

操作技术 OPERATIVE TECHNIQUE

术前计划 PRE-OPERATIVE PLANNING

尽可能拍摄全景前后位片和侧位片，包括相邻的关节。特别是暴力导致的粉碎性骨折，要考虑并发股骨颈骨折的可能。对于高位的粉碎性骨折，需拍摄对侧健肢的 CT 片或 X 线片作为对照，并用来确定患肢骨折前的长度。

Full antero-posterior and lateral views if possible, should be taken to include the adjacent joints. In comminuted and high velocity injuries in particular, the possible presence of a concomitant neck fracture should be considered. In highly comminuted fractures, a calibrated CT or X-ray of the opposite, uninjured side should be taken to establish the original length of the femur.

准确的术前计划对于股骨髓内钉成功交锁非常关键，从 36 英寸远的距离摄片将导致骨头放大 10%~15%。髓内钉的正确长度为大转子的顶端到股骨髓的干骺线；直径以侧位 X 线片上的狭部宽度为准；通过 X 片也可以确定合适的近端和远端锁钉的长度。非常靠近远端的骨折，要确保远端的近侧锁钉远离骨折线至少 1cm，这一点非常重要。当然，精确的髓内钉的直径和锁钉长度只有在术中才能确定。

Proper preoperative planning is essential to successful interlocking nail of the femur. Xrays taken at a 36-inch distance from the x-ray source result in 10-15 percent magnification of bone. The proper length of nail should extend from the tip of the greater trochanter to the epiphyseal scar. The diameter of the femoral nail should match the isthmus in the lateral X-Ray projection. The likely length of the proximal and distal locking screws can also be estimated through X-ray. In very distal fractures it is important to ensure that the more proximal of the two distal screws will be at least 1 cm distal to the fracture line. However, the exact dimensions of the nail and the length of the locking screws can only be determined during the operation.

医生须仔细阅读 X 线片，确定不存在解剖变异。

The surgeon should review the X-Ray to assure that there are no unusual anatomic variations.

只要病人情况允许，不管什么时候，股骨骨折都应该在受伤 24 小时内作固定。

Whenever possible, femoral fractures should be stabilized within the first 24 hours following injury, provided the patient's condition will allow it.

骨折复位

FRACTURE REDUCTION

急诊病例的股骨交锁髓内钉插入，需要用骨折复位床（图 1）或复位器械来帮助完成，因为它不仅能进行骨折复位，而且方便在大转子处自由选择入钉点。选择仰卧位或者侧卧位，仰卧位作为推荐体位，除非患者为多发伤或者情况较差。

All nail insertions in acute cases should be performed using a traction table(Fig.1) or a reduction device. This serves not only to reduce the fracture, but also permits free access to the greater trochanter. The supine or the lateral decubitus position may be used, but the supine position is recommended when the patient is multiply injured or in a poor condition.

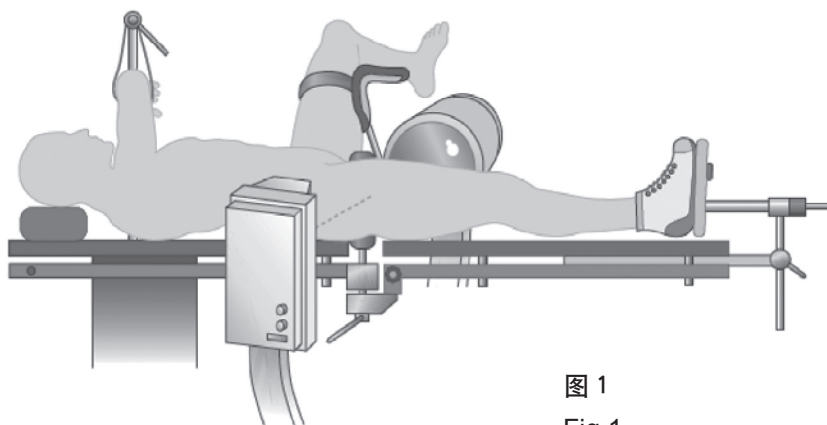


图 1

Fig.1

仰卧位

SUPINE POSITION

- 通过将躯干向健侧倾斜 25° 改良手术入路。
- 在手术床的边上安装支柱保证躯体的体位安全。
- 健肢置于妇科支架，允许影像增强器自由移动，以拍摄整个患肢。
- Access is improved by inclining the trunk towards the uninjured side by about 25°.
- The position of the trunk is secured by supports mounted on the side of the operating table.
- The uninjured limb is positioned on a gynecological legrest to allow the Image Intensifier free access to the whole of the fractured femur.

骨折复位 (续)

FRACTURE REDUCTION (CONTINUED)

以牵引和对抗引为原则，完成股骨骨折的复位。

Reduction of the femur is based on the principle of traction and counter-traction.

■ 对抗牵引通过标准引床中间的支柱抵住会阴部来完成，须用软垫填实，以避免会阴部因挤压而受伤。
■ 牵引通过在股骨远端插入 4mm 的斯氏针来实现（图 2），穿针的部位尽量远离骨折部位，以免妨碍远端锁紧，也可以通过胫骨结节牵引来完成。为了避免污染，最好在术前即患者被安置于骨折复位床之前，完成牵引针的插入。

■ Counter-traction is provided by a central pole that is available for attachment to standard traction tables, and sited at the perineum. It must be adequately padded to avoid pressure injury.

■ Traction is exerted through a 4 mm Steinmann type pin inserted through the femoral condyles as distally as possible (Fig.2), to avoid contact with the end of the nail. If the fracture is very distal, traction may be applied by means of a pin inserted at the level of the tibial tuberosity. To avoid contamination, it is preferable that a femoral traction pin is inserted at the beginning of the operation, before the patient is set up on the fracture table.

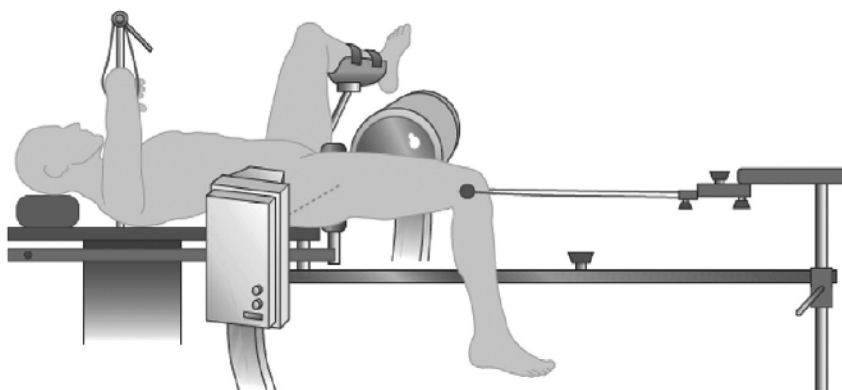


图 2

Fig.2

如果手术因故被推迟，最好在手术的时候，用胫骨结节牵引针替换股骨针来完成和维持复位，以避免骨折部位污染的可能。

If surgery is delayed for any reason, it is better to achieve and maintain reduction through a proximal tibial pin or wire which is exchanged for a femoral pin at the time of surgery, to avoid possible contamination of the fracture.

股骨干骨折 SHAFT FRACTURES

通常沿股骨轴线进行牵引完成复位。

It is usually sufficient to pull along the axis of the femur to achieve reduction.

远端骨折 DISTAL FRACTURES

将下肢内收（图 3），拍 X 线前后位片证实恢复了股骨的正常轴线，有时需要外展或屈曲膝关节来进行解剖复位，并拍侧位片证实。

The limb is adducted until the AP view shows normal configuration of the femoral axis(Fig.3). This is followed by extension or occasionally flexion of the knee until anatomical reduction is also evident in the lateral view.

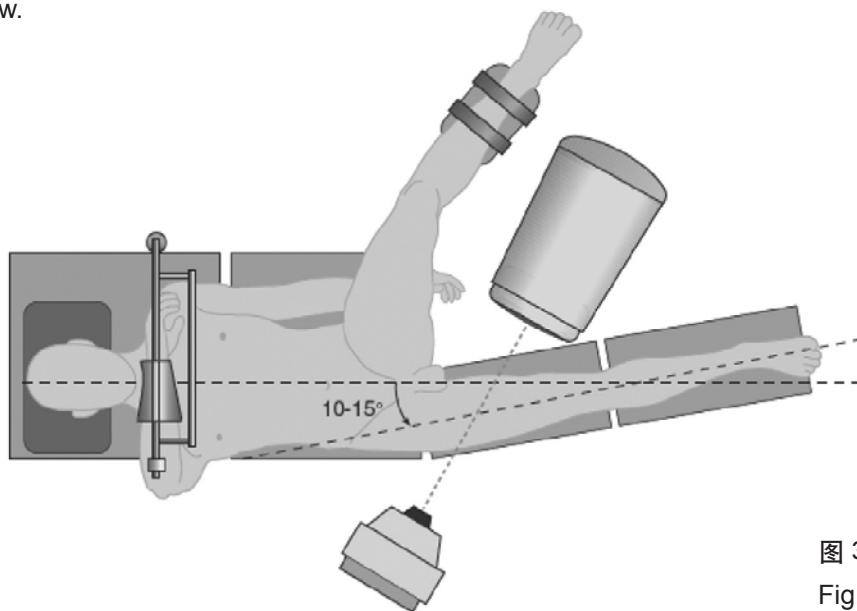


图 3
Fig.3

近端骨折

PROXIMAL FRACTURES

非常靠股骨近端的骨折，有时单独通过牵引床很难完成近端骨折块的复位，需要在术中按照后述方法进行调节。

It is sometimes not possible to correct the anterior displacement of the proximal fragment in very proximal fractures by means of the traction table alone. Additional measures may have to be taken intra-operatively, and these will be described below.

侧卧位

LATERAL DECUBITUS POSITION

侧卧位不作为推荐体位，仅限于多发伤患者。

The lateral decubitus position is not recommended since access to the patient in multiple trauma victims is limited.

患者准备

PREPARATION OF THE PATIENT

保证影像增强器能自由移动，从正侧位都可以拍摄股骨全长，备皮范围包括髂前上棘到胫骨近端。常规消毒铺巾，暴露髂前上棘至股骨髁部，包括大转子顶端附近 15cm 皮肤。髁部牵引针必须铺巾覆盖，但不能影响远端锁紧。推荐使用透明的皮肤粘贴纸，覆盖裸露的皮肤，特别是股骨近端外侧。术前请务必先行良好复位。

The Image Intensifier should have free access to the entire femur in both planes. The leg is shaved from the anterior superior iliac spine to the proximal tibia. After the skin has been prepared, the leg is draped so that the femur is completely accessible from the region of the anterior superior iliac spine to the distal end of the condyles, with about 15 cm of exposed skin visible proximal to the tip of the greater trochanter. The skeletal traction pin must be covered by drapes, but these must not interfere with distal locking. The use of a transparent adhesive skin drape around the exposed skin, centred on the lateral side, is recommended. DO NOT START SURGERY UNLESS THE FRACTURE IS WELL REDUCED.

正确辨认入点

IDENTIFICATION OF THE CORRECT ENTRY PORTAL

再次使用影像增强器来确定骨折复位，应该在开始外科手术前尽可能地进行精确的解剖复位。沿大转子作 7-10cm 的纵形切口，在切开阔筋膜张肌前完成止血。触诊大转子，阔筋膜张肌从大转子正中线纵形切开，再次通过触诊确定大转子的大小，在大转子的中线确定进钉点。如果不能完全确定进钉点，将大转子全部暴露是可取的，特别是靠近股骨近端的骨折，清楚地显露大转子，对于确保进钉入口正确非常重要。

Fracture reduction is again confirmed with the Image Intensifier. Anatomical realignment should be as accurate as possible before surgery commences. A 7-10 cm incision proximal to the greater trochanter is required. Haemostasis should be carried out once the iliotibial band has been reached. The tip of the greater trochanter is palpated, and the fibres of the iliotibial band are divided exactly in the middle of the trochanter. The dimensions of the trochanter should be checked by palpation, to locate the insertion point in the mid-line. It is advisable to expose the greater trochanter if there is any uncertainty, and in proximal fractures especially, a clear view of the greater trochanter is important to ensure the correct portal of entry.

正确的进钉点在梨状窝（图 4），暴露至外侧壁即大转子的内侧。进钉点不能太靠近内侧，以免损伤旋股动脉。

The correct point of entry is the piriform fossa, close to its lateral wall(Fig.4), just medial to the greater trochanter. The point of insertion should never be too medial, in order to avoid injury to the Circumflex Femoral Artery.

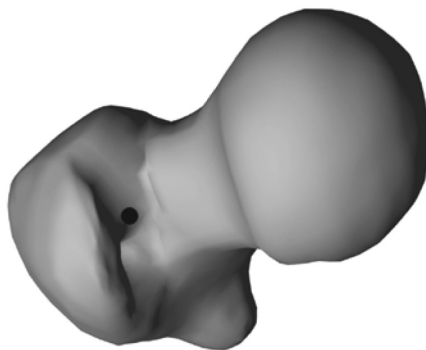


图 4

Fig.4

正确辨认入点（续）

IDENTIFICATION OF THE CORRECT ENTRY PORTAL (CONTINUED)

用髓腔开孔器靠近大转子在梨状窝的外侧缘开孔（图 5），通过影像增强器确定髓腔开孔器的尖端位于梨状窝。

The piriform fossa is opened with the Pointed Awl at its lateral border, close to the greater trochanter(Fig.5). The Pointed Awl is inserted and the Image Intensifier used to confirm that the tip of the awl is in the piriform fossa.

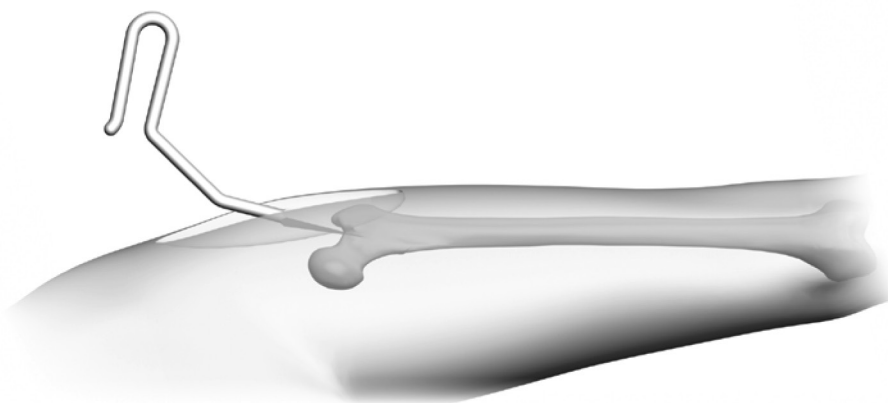


图 5
Fig.5

拍摄正侧位片以确定开孔器的尖端对准股骨干的轴线是非常关键的，最终的插入点一定要完全符合骨髓腔的轴线，而不只是凭解剖标志来确定。将手柄前移或者在冠状面上移动，调节开孔器的位置到符合股骨近端的解剖结构。

It is vital that the tip of the awl is directly in line with the axis of the diaphysis in both planes, and the final insertion point should be governed by the alignment of the awl with the medullary canal, and not only by anatomical landmarks. Movement of the handle in the frontal or coronal plane will correct the position of the awl to accommodate any anatomical variation in the proximal femur.

扩髓

REAMING

通常从使用 9mm 的扩髓钻插入开始扩髓（图 6），扩髓应该以每 1mm 为增量依次进行。缓慢轻柔扩髓以避免导致髓腔高压。扩髓到预计的髓内钉直径大 1mm。粗隆部位应该使用硬扩髓钻小心地扩至 14mm 以适应髓内钉近端大小。

Begins with the 9 mm Flexible Reamer, which is inserted over the guide wire with Olive9 (Fig.6). Reaming may be carried out in 1 mm increments until the cortex of the isthmus is reached. Slow reaming with a light hand is strongly recommended to avoid causing high intramedullary pressures. Reaming should be carried out to a width 1 mm greater than the proposed nail. The trochanteric region should be reamed to 14mm in diameter in hard bone to accommodate the implant, using the Rigid Reamer. Use caution in advancing the Rigid Reamer.

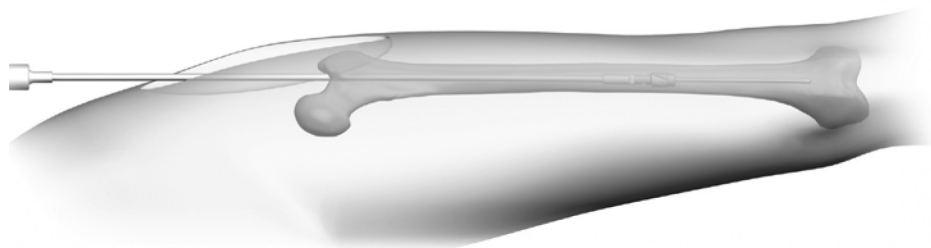


图 6

Fig.6

选择髓内钉 NAIL SELECTION

选择的髓内钉的直径比最后使用的扩髓钻头要小 1mm，髓内钉的长度可以通过测量扩髓钻的长度来确定。

The diameter of the selected nail should be 1 mm smaller than that of the last reamer used. Nail length may be determined by measuring the remaining length of the Flexible Reamer.

选择合适长度和直径的髓内钉，将吊紧螺栓插入手柄，将选好的髓内钉安装在手柄上（图 7）。

Nail of correct diameter and length is now selected. The Locking Rod is inserted into the back of the Nail Support Handle and the chosen nail into the nail support(Fig.7).

将髓内钉安装在正确的位置，并用 SW5 吊紧扳手旋紧吊紧螺栓来完成髓内钉的紧固（图 8）。插入髓内钉之前检查髓内钉与导杆的近端和远端的孔是否对应，这点非常重要。为做到这点，需按照后述的“远端锁紧”和“近端锁紧”，过程将导杆安装在手柄上。

The nail must be rotated until it seats into the correct position and the Locking Rod is then firmly tightened into the nail, completing this with the SW5 Wrench(Fig.8). Before the nail is inserted, it is important to check alignment of the distal and proximal holes in the nail and the Guide Bar. In order to do this, the Guide Bar is mounted on to the handle following the procedures described below under “Distal Locking” and “Proximal Locking” pages.

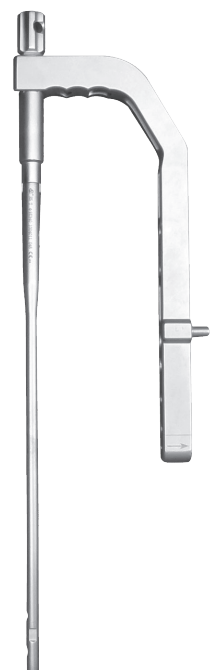
注意：髓内钉的弧度必须与股骨的解剖弧度相对应。

Note: Curvature of the nail must match the curvature of the femur.

图 7
Fig.7



图 8
Fig.8



选择髓内钉（续）

NAIL SELECTION (CONTINUED)

将髓内钉插入髓腔，可以通过旋转来帮助插入。理想状况下，可以徒手插入髓内钉，但轻轻敲击可能是必要的，使用打入（拔出）器敲击吊紧螺栓尾部（图9）。建议髓内钉穿过骨折断端时使用影像增强器。

The nail is now passed over by using rotational movements to assist its passage. Ideally, the nail should be inserted by hand, but gentle tapping may be necessary. The Sliding Hammer can be used over the guide wire to hammer the end of the locking rod(Fig9). The use of image intensification is recommended when passing the fracture.



图 9
Fig.9

当手柄上的阶梯与大转子的顶端齐平时，说明髓内钉插入至正确的深度（图10）。股骨干远端骨折，需要适当地调整髓内钉插入的深度，以确保锁钉避开骨折断端。应该检查并确保骨折不存在分离移位，否则容易导致骨不连。

The correct depth of insertion has been reached when the step of the nail support is at the same level as the tip of the greater trochanter(Fig10). In some distal metaphyseal fractures the exact depth of insertion may be adjusted to ensure that the locking screws will be clear of the fracture. A check should be made to ensure that the fracture is not distracted, as this has been associated with non union.



图 10
Fig.10

近端锁紧

PROXIMAL LOCKING

为保持钻孔方向与远端骨面垂直，理想的近端交锁平面相比冠状面前倾 20°。一旦确定好这个平面，就可以植入锁钉。在手柄上的二个孔对应的皮肤作二个小切口，钝性分离软组织，直达骨面。

The Proximal Guide Bar Locking Screw is inserted into the appropriate holes. It is then locked in this position. The ideal locking plane is about 20° anterior to the frontal plane, so that the surface of the bone distally is at right angles to the direction of drilling. Once this plane has been established, insertion of the locking screws is carried out. Two small stab incisions are made at the level of the holes in the guide bar, and extended down to the bone with blunt dissection.

分别从二个孔插入带软组织保护器 (ø8) 的螺钉套 (ø10/ø8)，推入到骨面 (图 11)。

Two Screw Guides(ø10/ø8) are inserted into the holes in the guide bar and pushed in turn down to the bone using the Obturator(ø8)(Fig.11).

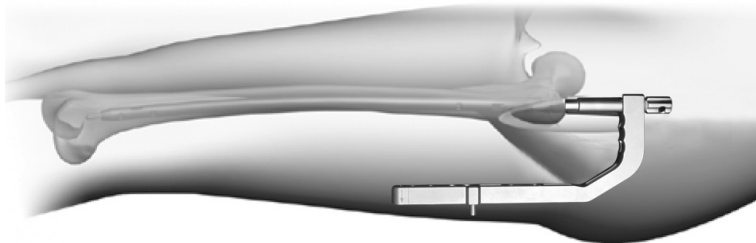


图 11

Fig.11

近端锁紧 (续)

PROXIMAL LOCKING (CONTINUED)

把钻套 (ø8/ø4) 插入内侧的螺钉套, 轻敲以使钻套的齿纹嵌入骨皮质, 然后将近端带有骨钻限位套的 ø4 骨钻插入钻套, 抵住骨面, 轻压使钻头的尖端紧压住骨皮质。

A Drill Guide (ø8/ø4) is inserted into one screw guide, and tapped gently to engage its teeth in the bone. A 4mm Drill Bit with the Drill Stop attached to it at its proximal end is introduced into the drill guide down to the bone before the drill is started. Gentle pressure is applied to the point of the drill bit on the cortex.

禁止用 ø6 骨钻进行锁钉的钻孔。

DO NOT USE THE ø6 DRILL BIT TO DRILL THE HOLES FOR THE LOCKING SCREWS.

医生可以从股骨外侧骨皮质平稳地钻孔 (图 12), 当钻头抵住对侧骨皮质时, 应将骨钻限位套向下移动至离钻套 10mm (相当于对侧骨皮质的厚度) 并固定好, 再继续钻孔。骨钻限位套可以保护远侧软组织, 并且可以提供估计锁钉正确长度的方法。

The surgeon now drills steadily through the lateral cortex (Fig.12). The drill should be stopped when the second cortex is reached. The Drill Stop is moved down until it is about 10 mm above the top of the Drill Guide, and fixed into place. This represents the thickness of the second cortex. Drilling is now continued through the second cortex. The Drill Stop prevents damage to the tissues beyond the bone, and also provides a method of estimating the correct length of the locking screw.

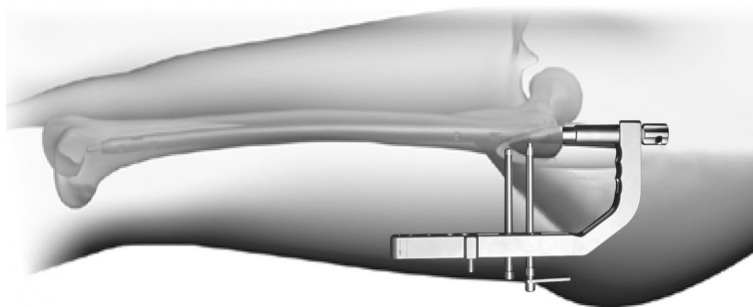


图 12
Fig.12

近端锁紧 (续)

PROXIMAL LOCKING (CONTINUED)

取出骨钻和钻套，将骨螺钉代替杆插入螺钉套，穿过髓内钉和远侧骨皮质，固定住导杆的位置。钻另一个孔前必须插入骨螺钉代替杆（图 13）。

The Drill Bit is removed with the Drill Guide. The Graduated Angled Trocar is now inserted into the Screw Guide, so that it passes through the nail, and engages the far cortex. This trocar has now stabilized the position of the Guide Bar. Do not drill the second hole before inserting the angled trocar (Fig.13).

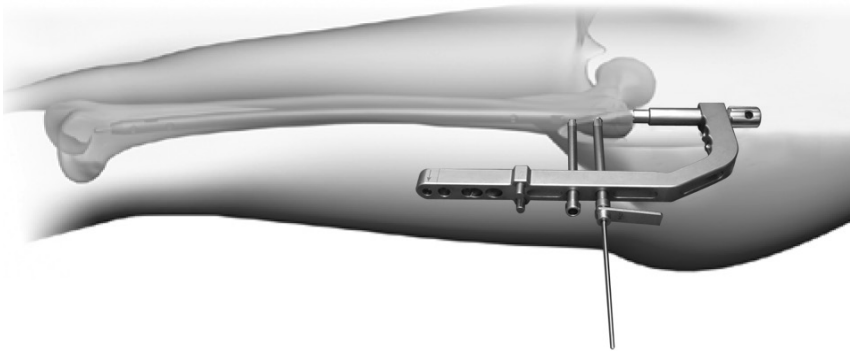


图 13

Fig.13

锁钉的长度是从螺钉帽底部至螺钉尖的距离，可以通过测量露出钻套的钻头的长度来确定，钻头的锥形部分忽略不计（图 14）。先记下锁钉的长度，而不植入锁钉。

The appropriate length locking screw, measured from the base of the screw head to its tip, is determined by measuring the amount of drill bit protruding from the drill guide, ignoring the tapered end. A locking screw of this length is reserved(Fig.13), but not yet inserted.

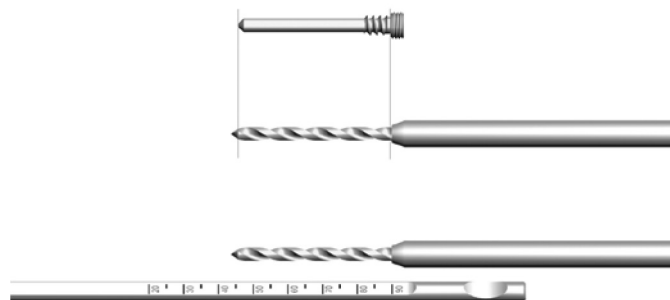


图 14

Fig.14

近端锁紧 (续)

PROXIMAL LOCKING (CONTINUED)

用同样的操作技术钻好另一个孔，并按上述方法确定所需锁钉的长度。

The second locking hole is now drilled, using an identical technique. The length of the second locking screw is determined as described above.

用骨螺钉六角扳手将合适长度的螺钉插入第二个螺钉套，径直将螺钉推入，至螺纹抵住骨皮质为止。注意六角扳手上环形标记，当锁钉推到底时这个标记高于螺钉套的顶部 8–20mm。在螺钉没有推到位前不需要拧动骨螺钉丝锥，因为此时没有螺纹嵌入骨皮质。稳定地顺时针拧动 T 型手柄，可以轻压手柄，直至六角扳手上的标记和螺钉套顶部齐平（图 15）。再多拧一圈使锁钉完全拧紧。注意不要继续拧紧以防止破坏骨皮质里的螺纹。

A locking screw of correct length is now inserted into the second screw guide, and pushed through the bone with the Hex Screwdriver first, until its thread engages the lateral cortex. Note that there is a circular mark on the T-wrench until this position has been reached, because there will be no thread in contact with the bone. The T-wrench is now turned steadily clockwise, exerting gentle pressure, until the mark on the shaft of the T-wrench reaches the top of the screw guide. One more full turn should be made to tighten the screw fully. It is important not to continue turning after this position has been reached (Fig.15), or the thread in the bone will be stripped.

取出第一个孔的骨螺钉代替杆，按照同样的技术植入另一个锁钉，再取出两个螺钉套。在进行远端锁紧前，须最后须检查旋转和分离移位是否都已经纠正。

The trocar is removed from the first Screw Guide, and the same technique followed for insertion of the second locking screw. Both Screw Guides are now removed. Before proceeding with distal locking, a final check must be made to ensure that any rotational deformity has been corrected, and that there is no distraction of the bone ends at the fracture site.

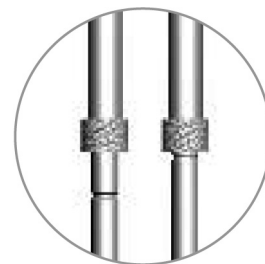
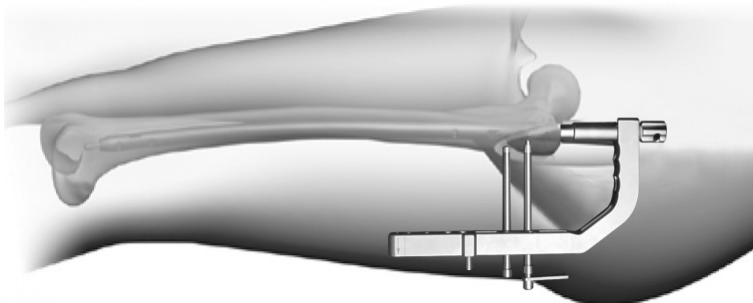


图 15
Fig.15

远端锁紧

DISTAL LOCKING

因为软组织收缩张力及骨髓腔的限制，髓内钉将产生一定的弯曲形变。向内外侧的形变将不会对远端锁紧产生明显的影响，因为正是锁钉植入的平面；但是前后弯曲形变将导致锁紧失败。远端稳定系统就是为了纠正导杆和髓内钉前后位的对准关系而设计，远端支架提供定位杆安装的位置，定位杆可以穿过股骨前面的骨皮质插入，而抵住髓内钉，并用卡子纠正和固定远端支架及定位杆的距离。

There may be some bending of the nail, due to the pressure and weight of the soft tissues and the bone. Medio-lateral bending of the nail will not affect the targeting significantly, since this is the plane of screw insertion, but any bending antero-posteriorly will result in failure of the locking. The stabilizing system is therefore designed to correct anteroposterior alignment between the guide bar and the nail. The Distal Outrigger provides the mounting point for a Stabilizing Rod which is inserted down to the nail through the anterior femoral cortex, and the U-shaped Stabilizing Spacer correct the distance and lock the Stabilizing Rod to the outrigger.

按照下述方法进行远端锁紧：

- 将导杆固定在合适的位置并纠正髓内钉的任何弯曲形变。
- 作远端锁紧的切口，插入螺钉套至骨皮质，并完成整个锁紧过程。

The stages of distal locking therefore are as follows:

- Stabilize the guide bar in the appropriate position to correct for any bending of the nail.
- Make the incision(s) for distal locking, insert the screw guides down to the bone, and complete the procedure.

远端支架的稳定

STABILIZATION OF THE DISTAL OUTRIGGER

将远端导杆安装到近端支架上并徒手拧紧导杆锁轮（图 16），远端支架上有两个孔以适配于近端支架，选择正确的孔安装，组装的导向杆的弧度与股骨及髓内钉的弧度相匹配。

The Distal Guide Bar is attached to the Proximal Guided Bar and the Bar Locking Screw tighten firmly by hand (Fig.16). There have tow holes for locking screw to fit in the Proximal Guide Bar. Mark sure to use the correct one that will promise the curvature of the guide bar structure match the curvature of the femur or the nail.



图 16

Fig.16

远端锁紧（续）

DISTAL LOCKING (CONTINUED)

将远端支架于远端锁钉孔中间的位置安装在导杆前边，徒手拧紧远端支架手轮（图 17）。

The Distal Outrigger is now attached on the anterior side of the guide bar, at the middle of the two distal locking holes. The Distal Outrigger Locking Screw is tightened firmly by hand(Fig.17).

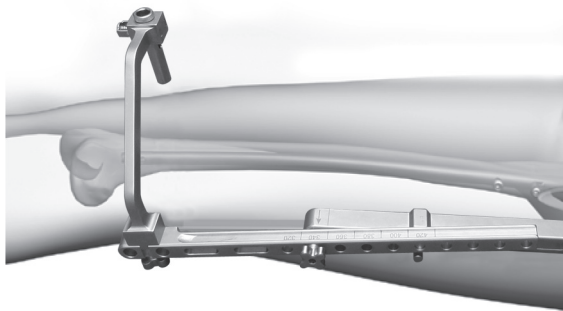


图 17

Fig.17

将定位杆导套（ $\phi 10/\phi 8$ ）插入远端支架孔至皮肤，并通过触诊将其对准股骨中央位置放置，在套筒下方作一 15mm 切口至深筋膜，将肌肉组织纵形分离直至骨面。

A Stabilizing Rod Guide is inserted through the hole in the outrigger down to the skin anteriorly, and by palpation is centred over the middle of the femur. The point of contact with the skin is noted. A 15 mm incision is made at this point, down to the deep fascia. The muscle is then split longitudinally down to the bone.

将软组织保护器插入螺钉套，并推向骨面，通过触诊和轻压导杆使软组织保护器位于股骨干中央（图 18）。

The Obturator is inserted into the Screw Guide, and the two pushed together down to the bone. The Screw Guide is centered over the middle of the femoral shaft, by palpation, using gentle pressure on the guide bar in the frontal plane(Fig.18).

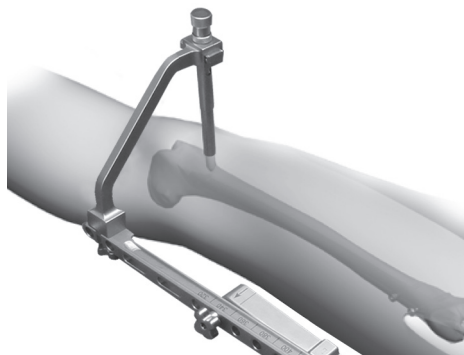


图 18

Fig.18

远端锁紧（续）

DISTAL LOCKING (CONTINUED)

取出软组织保护器，插入钻套（ $\phi 8/\phi 6$ ），并将 $\phi 5$ 骨钻插入钻套至骨面，轻压钻头使其抵住骨皮质，然后进行前侧骨皮质钻孔（图 19）。

The Obturator is withdrawn, and the Drill Guide ($\phi 8/\phi 6$) inserted. The $\phi 5$ DRILL BIT is inserted down to the bone, using gentle pressure to keep the point in contact with the cortex. The anterior cortex only is then drilled (Fig.19).

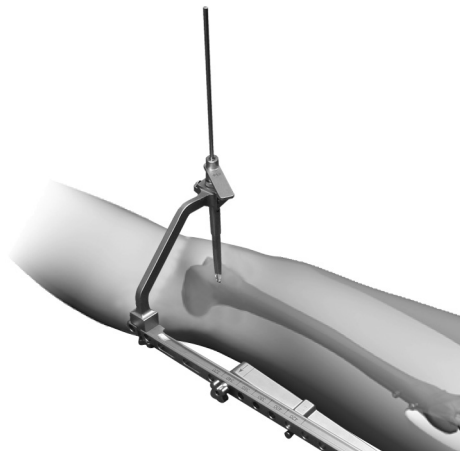


图 19

Fig.19

取出钻头，插入 $\phi 5$ 平底钻，转动手钻清除股骨孔内骨屑，直至听到或手感手钻尖端触及髓内钉，向髓内钉轻敲手钻也可以帮助确定，再取出手钻。

The drill bit is removed and the 5mm T-Orill Bit inserted. The hole in the bone is cleared by turning the hand reamer, until its tip can be heard and felt touching the nail. Tapping the nail to confirm contact may be helpful. The hand reamer is then removed.

将定位杆插入螺钉套，穿过前侧骨皮质直至髓内钉（图 20），轻敲定位杆证实已经抵住髓内钉。

The Stabilizing Rod is inserted through the Screw Guide, and the hole in the anterior femoral cortex, down to the nail (Fig.20), contact being confirmed by tapping its tip on to the nail.



图 20

Fig.20

远端锁紧（续）

DISTAL LOCKING (CONTINUED)

轻抬支架，使弹簧卡块能卡入定位杆的圈型卡槽入。卡入时，可以听见“叭”的卡入声。

Lift the handle gently so that the tip is in contact with the nail, A “click” can be heard when the tip is in.

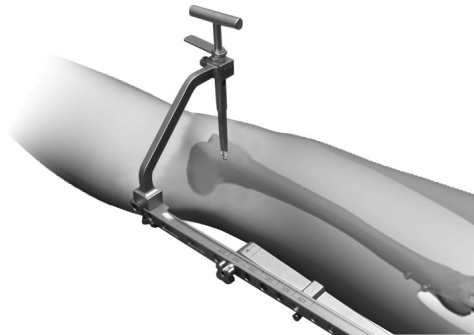


图 21

Fig.21

从导杆远端的二个孔内分别放入螺钉套（图 22），于二孔之间对应的皮肤上作一个 4-5cm 的皮肤切口至深筋膜，钝性分离软组织，纵向切开髂胫束直至股骨，注意保持切口和髂胫束的纤维排列方向一致。Screw Guides are now inserted through each of the holes in the guide bar (Fig.22). A single 4-5 cm incision is made over the points of contact with the skin, down through the deep fascia. The incision is deepened by blunt dissection, splitting the ilio-tibial tract longitudinally, down to the bone, taking care to keep the incision in line with the fibres of the iliotibial band.

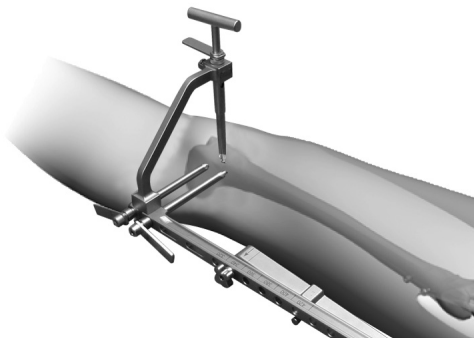


图 22

Fig.22

借助于软组织保护器将近侧螺钉套插入至骨面（图 23）。

The more proximal screw guide is now inserted down to the bone, with the aid of the Obturator(Fig.23).

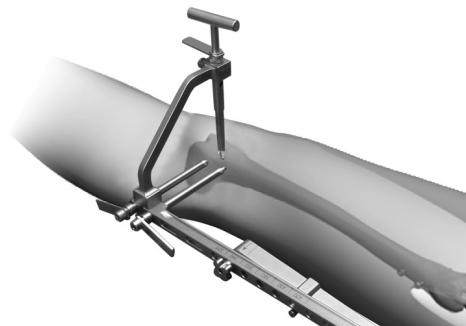


图 23

Fig.23

远端锁紧 (续)

DISTAL LOCKING (CONTINUED)

将钻套 (ø8/ø4) 插入螺钉套 (ø10/ø8), 轻敲使齿纹紧压骨皮质, 再将 ø4 骨钻插入钻套, 并把骨钻限位套锁定在骨钻尾部 (图 24)。

A ø4 Drill Guide is inserted into this screw guide, and tapped gently to engage its teeth in the bone. The ø4 Drill Bit is attached to the drill guide, and the Drill Stop locked to it at its proximal end(Fig.24).

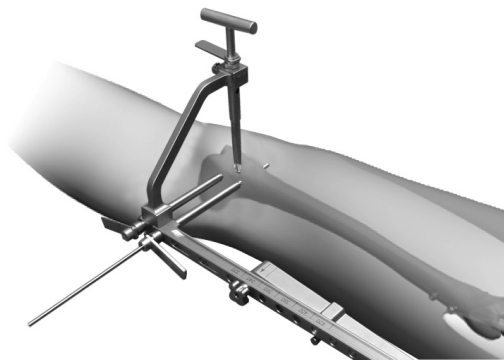


图 24
Fig.24

先钻好近侧锁钉孔, 再拔出钻头。在钻孔前使用定位针 (ø4) 在骨皮质钻一沉孔, 可以增加钻头的稳定性。

The first locking hole is now drilled as for proximal locking, and the drill guide removed. A Pin(ø4) can also be used to drill a recess on the cortex before using Drill Bit to increase its stability.

插入骨螺钉代替杆 (图 25), 穿过髓内钉和远侧骨皮质, 这样可以固定住导杆的位置。禁止在插入骨螺钉代替杆前钻另外一个锁钉孔。

The Graduated Angled Trocar is now inserted into the Screw Guide(Fig.25), so that it passes through the nail, and engages the far cortex. This trocar has now stabilized the position of the guide bar. Do not drill the second hole until the angled trocar is in position.

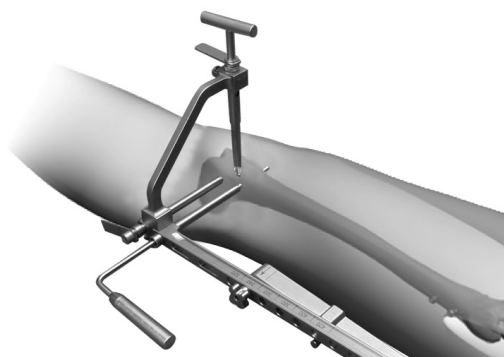


图 25
Fig.25

远端锁紧 (续)

DISTAL LOCKING (CONTINUED)

正确的锁钉的长度是从螺钉帽底部至螺钉尖的距离。先记下长度，但不植入锁钉。

The appropriate length locking screw, measured from the base of the screw head to its tip, is determined as before, and a locking screw of this length reserved, but not yet inserted.

将远侧的螺钉套及软组织分离器向前推至骨面，将骨钻限位器推回钻头尾部，采用同样的技术钻好另一个锁钉孔（图 26），并按照前述方法确定锁钉长度。

The distal Screw Guide is now advanced down to the bone using the straight trocar and locked in position. The Drill Stop is returned to the proximal end of the drill bit and the second locking hole drilled (Fig.26), using an identical technique. The length of the second locking screw is determined as described above.

用骨螺钉六角扳手将合适长度的锁钉插入第二个螺钉套，将螺钉推入，至螺纹抵住骨皮质为止，再按照前述的近端锁紧方法拧入锁钉（图 27）。

A locking screw of correct length is now inserted into the second Screw Guide, pushed through the bone with the Hex Screwdriver until its thread engages the lateral cortex, and screwed into place as described for proximal locking (Fig.27).

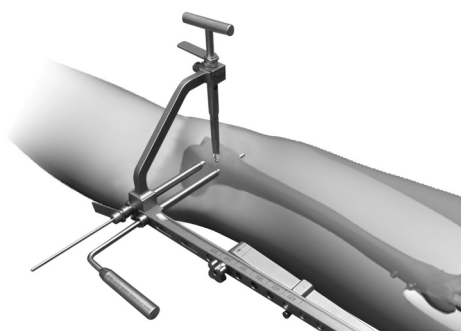


图 26
Fig.26

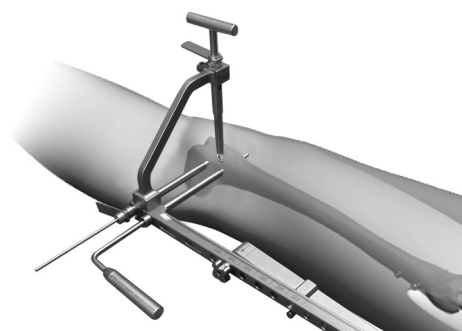


图 27
Fig.27

取出第一个螺钉套的骨螺钉代替杆。采用同样的技术植入另一个锁钉。把两个螺钉套取出。现在需要使用影像增强器或者 X 线检查来确定锁钉都穿过髓内钉并且骨折复位没有丢失后，拆除定位杆、螺钉套以及远端支架。

The graduated trocar is removed from the first screw guide. The same technique is followed for insertion of the remaining locking screw. After which both screw guides are removed. A check is now carried out with the Image Intensifier or by X-ray to confirm that both screws have passed through the nail and that reduction has been maintained. The Stabilizing rod, Screw Guide and Distal Outrigger are removed.

评估锁钉长度的另一种方法 – 利用测深尺

ALTERNATIVE METHOD OF ESTIMATING LOCKING SCREW LENGTH USING THE DEPTH GAUGE

如果不能肯定锁钉的正确长度，无论是为验证钻孔后取得的测量值，或者因为外科医生忽略了这个步骤，都可以按下述方法使用测深尺：医生首先要检查螺钉套在正确的位置，即前端抵住骨面。拧松并取下测深器的保护套。

If there is any doubt about the correct length of locking screw, either in respect of the measurement recorded following drilling, or because the surgeon omitted this step, the Depth Gauge may be used as follows: the surgeon should first check that the screw guide is positioned so that it is touching the bone. The depth gauge cover is then unscrewed and removed.

将测深尺带钩端插入螺钉套穿过对侧骨皮质，再往回拉使之钩住远侧骨皮质表面。锁钉的正确长度就可以在螺钉套顶部平面读出。这种测深尺只适合 WASTON 的胫骨和股骨髓内钉，因为它的精确度依赖于螺钉套的固定长度。

The hooked end is inserted down the screw guide and through the bone. It is then drawn back so that the hook engages the outer surface of the distal cortex. The correct length of screw can now be read at the top of the screw guide. This depth gauge is only suitable for use with Trauson Tibial and Femoral nails, since its accuracy depends on a fixed length of screw guide.

更换锁钉

LOCKING SCREW REPLACEMENT

如果在手术过程中，无论何种原因须更换锁钉，需要使用骨螺钉螺纹扳手，通过导杆上相应的孔插入，按照后述的“髓内钉取出”章节进行操作。

If a locking screw should need replacing for any reason during the course of the operation, the Locking Screw Extractor should be used, inserting it through the appropriate hole in the guide bar, as described in the section on Nail Removal below.

最终检查

FINAL CHECK

在移除手柄之前，通过影像增强器或者 X 线片从正侧位来检查所有的锁钉都正确安装，确定所有锁钉都穿远侧皮质进行固定，这一点非常重要。通过 X 线检查也可以确定螺钉头底部紧贴皮质骨表面。

Before removing the handle from the nail, it is important to check all of the locking screws for correct insertion, both in the AP and lateral planes, either by image intensification or Xray films, ensuring that all pass through the nail and penetrate the distal cortex. These Xrays can also be used to confirm that the base of each screw head is firmly positioned against the surface of the cortex.

最后检查确认骨折复位是否满意，四个锁钉正确地通过交锁孔锁紧，螺钉头和骨皮质表面齐平，锁钉末端刚刚穿出对侧骨皮质（图 28）。

A final check is now made to confirm that fracture reduction is satisfactory, and that all four locking screws are correctly inserted through the nail, the screw heads flush with the bone, and the distal ends just protruding beyond the second cortex(Fig.28).



图 28

Fig.28

拆除手柄和关闭切口

REMOVAL OF THE HANDLE AND CLOSURE

用 SW5 的吊紧扳手旋转几圈松开吊紧螺栓，并拆除手柄。吊紧螺栓和手柄拆除后，用骨螺钉六角板手将封帽拧入髓内钉尾部（图 29）。注意髓内钉封帽的尾部没有螺纹，这就使得医生需要按照正确的方向将封帽推入髓内钉，从而避免损伤螺纹。

The handle is removed after loosening the Locking Rod a few turns with the SW 5 Wrench. Once the Locking Rod and the Handle have been removed, a Nail End Cap is placed over the end of the nail. Note that the nail end cap has an unthreaded portion at its end (Fig.29). This enables the surgeon to push the end into the nail to establish the correct alignment, and thereby avoid damaging the thread.

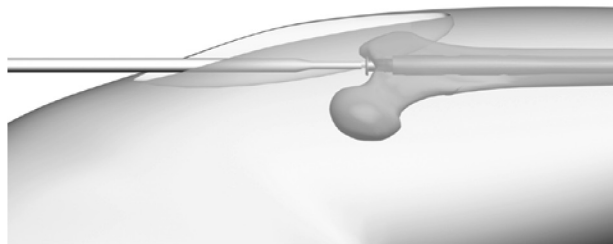


图 29

Fig.29

建议用生理盐水冲洗伤口而清除植入区域因扩髓产生的骨屑，减少骨组织异位形成的可能。

It is recommended that the insertion area is washed liberally with saline to remove any debris of reaming from the wound. This will reduce the likelihood of heterotopic bone formation.

通常只需在近端的切口处留置引流装置。必须修补所有切口的深筋膜，并按常规逐层缝合。无菌敷料加压包扎伤口，并用弹性绷带绕髋关节捆绑，以防止血肿形成。引流装置 24–48 小时后拔除。

In general, suction drainage should be used in the proximal wound only. The deep fascia should be repaired in all incisions, and all wounds should be closed in layers in the usual manner. Dressings should include a compression dressing and an elastic bandage wrapped around the hip, starting from the foot, in order to avoid wound seroma. The drain is removed after 24-48 hours.

术后处理

POST-OPERATIVE MANAGEMENT

负重

WEIGHT BEARING

鼓励病人在拔除引流装置后 1—2 天开始活动，建议开始在步行支架的保护下部分负重（重大 15 公斤负荷）。如果骨折稳定，而病人无不适，可以尽快地从部分负重递增至完全负重。对于重度粉碎性骨折，须逐步地增加负重，当 X 线片显示骨痂形成时才可以完全负重。因为骨折造成肌肉及韧带损伤，导致持续的疼痛，使得大多数股骨骨折病人在相当长一段时间里不会完全负重。无论怎样，应该鼓励病人尽可能早地完全负重。在临床实践中，稳定性骨折的病人比粉碎性骨折病人更趋向于股骨早期负重。

The patient may be mobilized on day 1 or 2, after drainage has been removed. Partial weightbearing (up to 15 kg load) in a walker frame is recommended immediately. If the fracture is stable, weightbearing may be increased to full body weight as soon as comfort will allow. With greater degrees of comminution, a programme of gradually increasing weightbearing should be instituted, up to full weightbearing when callus appears on the Xray. Most patients with femoral fractures will not put their full weight on the femur for some time, due to persistent pain resulting from the injury to muscles and ligaments usually sustained with this type of fracture. Full weightbearing should, however, be encouraged as soon as possible. In clinical practice, the patient with a stable fracture will tend to load the femur earlier than the patient with a more comminuted fracture.

鼓励病人术后即开始下肢肌肉的等长收缩锻炼，术后 4 天膝关节可以轻柔地开始活动。通常膝关节和髋关节可以通过锻炼恢复正常的活动范围。建议只有当病人主动、无痛地患肢负重超过体重 50% 时，才能进行积极的物理治疗，早期的过分的物理治疗是有害的。

Isometric muscle exercises for the whole limb should be encouraged from the outset. Gentle knee mobilization may be started after about four days, within the limits of comfort. Normally, a good range of knee and hip movement is achieved spontaneously. Active physiotherapy to the knee is recommended only when the patient is mobile, pain free and taking more than 50% of body weight through the leg. Too vigorous a programme of physiotherapy in the early stages may be harmful.

负重（续）

WEIGHT BEARING (CONTINUED)

避免服用非甾体类固醇药物，因为这类药物将影响骨折愈合。如果是 Winkquist—Hansen III—V 型粉碎性的不稳定性骨折，在骨折部位连续性骨痂生成前，仅允许部分负重。

Non steroidal anti-inflammatory drugs should be avoided, as these have been associated with non union. If the fracture is comminuted to Winkquist-Hansen Type 3-5, and is therefore unstable, and the nail diameter is 10 mm, only partial weightbearing should be permitted until the fracture is bridged by callus.

动力交锁

DYNAMIZATION

动力交锁，即拔除一对锁钉，不被推荐为标准操作技术的一部分。然而，如果骨折延迟愈合，建议取出远侧的一对锁钉。骨痂及机械稳定性形成的时间不会缩短，须髓内钉植入后 4—6 个月。

Dynamization, by removal of one pair of locking screws, is not recommended as part of the standard technique. Should there be a delay in union, however, removal of the pair of locking screws furthest from the fracture site is advised. The callus, and the mechanical stability of the femur at this time, should be such that shortening will not occur. This may be contemplated at four to six months following nail insertion.

骨不连

NON-UNION

骨不连的情况在股骨骨折很少出现，但是一旦发生，就应该制定治疗原则并按照其处理。如果是动力交锁后出现的肥大性骨不连，只需要增加稳定性，换用大号髓内钉就足够了；骨萎缩性骨不连，除了更换大号髓内钉外，还需要对骨折断端进一步的外科处理，包括清除死骨和松质骨植骨。

This is unusual in femoral fractures, but if it occurs, it should be treated according to established principles. A hypertrophic non-union after dynamization may only require additional stabilization, and exchange nailing with a larger diameter nail may be sufficient. In addition to exchange nailing, an atrophic non-union may need further surgery to the fracture site, which may include a cancellous bone graft and the possible removal of any devitalized bone.

取钉

NAIL REMOVAL

股骨交锁髓内钉取钉一般在术后 18–24 个月，须经放射线检查证明骨折愈合。一般交锁髓内钉内固定术后 4–5 个月股骨骨折愈合，而骨不连及截骨矫形术的情况会有所不同，这些病例取钉至少要术后 24 个月。患肢内收，作小切口暴露髓内钉的近端尾部，可能有必要清除一些覆盖住髓内钉尾部的新生骨。用骨螺钉六角扳手取出封帽，再将拔出手柄完全旋入髓内钉尾部，避免髓内钉尾部螺纹错位非常重要。

Nail removal may normally be carried out after 18-24 months provided there is radiological evidence of union. Union maybe expected to occur after 4-5 months following nailing procedures in the femur. The situation may be different in non-unions or corrective osteotomies. In such cases the nail should be left in situ for a minimum of 24 months. The proximal end of the nail is exposed through a small incision, with the leg in adduction. It may be necessary to clear some new bone from the end of the nail. The nail end cap is removed with the Screwdriver. The Screw Adapter is screwed fully on to the nail. It is important to avoid crossing the thread in the nail.

现在可以取出所有锁钉。当锁钉因为各种原因需要取出时（包括动态交锁，髓内钉取出，以及少数情况下锁钉长度不正确），可以按照下述方法使用骨螺钉螺纹扳手来完成：将骨螺钉螺纹扳手顶住锁钉头部，并且逆时针拧动。锁钉头部外沿上的螺纹是反向螺纹，所以在整个过程中必须逆时针拧动骨螺钉螺纹扳手。第一圈扳手和锁钉头部锁扣住，继续拧动扳手可以使锁钉的螺纹从骨中旋出。当螺纹部分全部脱出骨皮质，应该直接往后拔出锁钉，此时由于没有螺纹嵌在骨内，继续拧动毫无意义。应该顺时针方向旋转扳手把锁钉从扳手上旋下，这和通常的方向相反。这时用钳子抓住锁钉杆部可能是必要的。

The locking screws are now all removed. When locking screws require to be removed for any reason, (e.g. nail dynamization or extraction, or in the occasional case where the length of the chosen locking screw is incorrect), this maybe accomplished using the Locking Screw Extractor as follows: the Extractor is inserted down to the head of the screw, and is turned counterclockwise. The thread on the outside of the locking screw head is a verse thread, so it is necessary to turn the Extractor counterclockwise throughout this procedure. The first turns lock the extractor to the screw head, and further turns will release the screw thread from the bone. Once the thread has been disengaged from the cortex, the screw should be pulled out directly. Further turns at this point will achieve nothing, as no thread remains in the bone. Note that the locking screw is then disengaged from the extractor by turning the latter clockwise, which is the opposite direction to normal. It may be necessary to grip the smooth shaft of the screw with forceps during this procedure.

取钉（续）

NAIL REMOVAL (CONTINUED)

将打入（拔出）器连接在拔出器手柄上，通过反方向的敲击来取出髓内钉（图 30）。通常伤口愈合后，身体活动不受限制。

The nail is then removed by reverse hammering, after screwing the Sliding Hammer on to the proximal end of the Screw Adapter (Fig.30). In the normal course of events there is no restriction of physical activity once the wounds have healed.

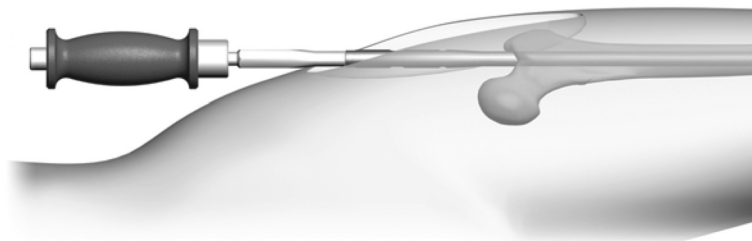


图 30

Fig.30

产品信息

PRODUCT ORDERING INFORMATION

工具 INSTRUMENTS

器械编号 Product No.	器械名称	Product Name	数量 Qty
15041-001	瞄准器手柄	Nail Support Handle	1
15041-002	导杆	Guide Bar	1
15041-003	远端瞄准支架	Distal Outrigger	1
15041-104	吊紧螺栓 (M10)	Locking Rod (M10)	1
15041-005	导杆锁轮 (M6)	Guide Bar Locking Screw (M6)	1
15041-006	支架锁轮 (M8)	Outrigger Locking Screw (M8)	1
15041-008	T 型定位杆 (Ø5.0)	T-Handled Stabilizing Rod (Ø5.0)	1
15041-109	专用套管 (Ø11/Ø9.2)	Screw Guide (Ø11 / Ø9.2)	2
15041-110/210	软组织分离器 (Ø8/Ø9)	Soft Tissue Protector (Ø8 / Ø9)	各 1
15041-011/311/411/511	钻套 (Ø2.7/Ø4.2/Ø5.2/Ø7.1)	Drill Guide (Ø2.7 / Ø4.2 / Ø5.2 / Ø7.1)	各 1
15041-012	螺纹导针 (Ø2.5 × 250mm)	Threaded Kirschner Wire (Ø2.5 × 250mm)	2
15041-013	测深尺 (50 ~ 110mm)	Depth Gauge (50~110mm)	1
15041-014	阶梯骨钻 & 限位器 (Ø7.0)	Drill Bit and Slide Limited Device (Ø7.0)	1
15041-015	上钉 (加压) 扳手 (SW6.0&M4)	T-Wrench with Coupling Screw for Lag Screw Impactor (SW6.0 / M4)	1
15041-016	把持器 (M10)	Handle for Impactor (M10)	1
15041-117	开孔器 (大)	Pointed Awl (Large)	1
15041-218/318/418/518/618/718/818	髓腔绞刀 (Ø8/Ø9/Ø10/Ø11/Ø12/Ø13/Ø14)	Rigid Reamer (Ø8 / Ø9 / Ø10 / Ø11 / Ø12 / Ø13 / Ø14)	各 1
15041-019	导针 (Ø2.5 × 600mm)	Guide Wire (Ø2.5 × 600mm)	1
15041-420/520	骨钻 (Ø4.0 / Ø5.0)	Drill Bit (Ø4.0 / Ø5.0)	1
15041-421	骨钻 & 限位器 (Ø4.0)	Drill Bit and Slide Limited Device (Ø4.0)	1
15041-022	T 型平底钻 (Ø5.0)	T-Drill Bit (Ø5.0)	1
15041-123	套管 (Ø10/Ø8.2)	Screw Guide (Ø10 / Ø8.2)	2
15041-025	直角定位杆	Stabilizing Rod	1
15041-026	测深器 (20 ~ 90mm)	Locking Screw Depth Gauge (20~90mm)	1
15041-027	丝锥 (HA6.0)	Tap (HA6.0)	1
15041-028	T 型六角扳手 (SW3.5)	Screw T-Wrench (Hex, SW3.5)	1
15041-029/129	L 型六角扳手 (SW2.5/SW5.0)	Screw L-Wrench (SW2.5/SW5.0)	各 1
15041-230	打拔器手柄 (M10)	Sliding Hammer with Detachable Swing Arm (M10)	1
15041-131	打拔器	Adapter for Extractor	1
15041-032	锁钉取出器 (M8 左旋)	Locking Screw Extractor (M8 Left)	1
15041-000	器械盒	Instrument Case	1 套
*15041-034	软钻 (Ø8 ~ Ø14.5)	Soft Drill Bit (Ø8~Ø14.5)	1

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